

ROSENTHAL (E.D.) *Compliments of the Author*

Reduced Period of Intubation by
the Serum Treatment
of Laryngeal Diphtheria

EDWIN ROSENTHAL, M.D.

PHILADELPHIA, PA.



Reduced Period of Intubation by the Serum Treatment of Laryngeal Diphtheria.*

EDWIN ROSENTHAL, M.D.,

PHILADELPHIA, PA.



At the last meeting of this society I had the honor of presenting a paper on the Treatment of Laryngeal Diphtheria by Diphtheria Antitoxin, with and without Intubation. Further experience in this method of treatment has so impressed me, that I am prompted to appear and place before the society the results of my further personal observations in the same character of cases, with this distinction—I shall limit myself to those cases only that required intubation, and place in comparison cases that were intubated prior to the serum treatment and cases that required tracheotomy. To do this properly I have sought aid from the statistics of others, and, placing them side by side, wish to prove:

1st. That the operation of intubation is the most desirable, and is more favorable than that of tracheotomy.

2d. That with the serum treatment of diphtheria tracheotomy will no longer be necessary in this disease.

3d. That the serum treatment in diphtheria has made a most marked

and favorable reduction in the time the tube is worn in the larynx.

As a basis I shall take the recoveries reported by me in a paper entitled, "A Report of 100 Cases of Diphtheria of the Larynx Treated by Intubation". (*Med. Bulletin*, September and October, 1894).

Inasmuch as formerly the major operation of tracheotomy was indicated in those cases requiring intubation longer than 120 hours (five days), or where severe decubitus was present, I shall divide these statistics into percentages, representing under and above 120 hours.

I shall also group my statistics into two divisions, representing American observers in the one part, and European observers in the other, and in a summary, group them together. My reason for so doing is because the technique pursued is different. As O'Dwyer justly says:

"The best statistics on this point will come from the other side, where it is customary to leave the string attached and to remove the tube every twenty-four to forty-eight hours. I however do not consider it good practice unless the string is removed."

*Read before the Medical Society of the State of Pennsylvania, May 21, 1896.

I may add that in my own practice I employ as many as five tubes of one size. So soon as the tube has been used I have it cleansed and re-gilded, and therefore use a comparatively new tube for each case. When the tubes are returned from my instrument makers, Messrs. Charles Lentz & Sons, Philada., they are thoroughly cleansed, boiled and then placed in my case for use. O'Dwyer's technique is followed, but the one intubation is performed if possible, waiting until I think the time most proper to make the final extubation. The silk, in all cases, is removed at once, and the patient permitted as much freedom as is compatible with safety. This method is pursued by most American operators, will explain the difference in the time between American and European statistics, and is the chief reason for the method of presenting my statistics.

BEFORE THE USE OF SERUM.

American—In my series of cases there were thirty-eight recoveries in 100 cases—a mortality of sixty-two per cent.

The tube was worn :

48 hours in 4 cases	}	. . . 31.40 Per cent.
60 " " 1 "		
72 " " 1 "		
96 " " 6 "		
120 " " 6 "	}	. . . 68.60 Per cent.
144 " " 6 "		
192 " " 5 "		
216 " " 5 "		
240 " " 2 "	}	
364 " " 1 "		
672 " " 1 "		

The minimum duration was forty-eight hours; the maximum, 672 hours. Taking the number of hours, 6,040, and dividing by the number of cases, thirty-eight, the average time the tube was worn was $185\frac{1}{2}$ hours.

To summarize :

Under 120 hours, 12 cases . . .	31.40 per cent.
Over 120 " 26 " . . .	68.60 "

Dillon Brown (June and July, 1887) places the time for final extubation at five days three and a half hours ($123\frac{1}{2}$ hours).

O'Dwyer collected 158 recoveries in which the time the tube was worn was accurately stated and the average found to be six days and two or three hours (146–147 hours).

Louis Fischer reports to me sixteen

recoveries in which the tube was worn, as follows :

50 hours, 1 case	} 25 per cent.
60 " 1 "		
72 " 1 "		
96 " 1 "		
148 " 2 "		
152 " 1 "	} 75 per cent.
164 " 1 "		
184 " 1 "		
192 " 1 "		
212 " 2 "		
340 " 2 "	}	
524 " 1 "		
624 " 1 "	}	

The minimum duration in Fischer's cases was fifty hours; the maximum, 624 hours. Taking the number of hours, 2,818, and dividing by the number of cases, sixteen, the average time the tube was worn was $176\frac{1}{8}$ hours.

To summarize :

Under 120 hours, 4 cases . . .	25 per cent.
Over 120 " 12 " . . .	75 "

European—Gustav Baer (*Trachotomie and Intubation in Kinderspital Zurich*, inaugural dissertation, Leipsic, 1892), performed final extubation in his cases of recovery at the Zurich Children's Hospital, as follows :

1 day in 1 case	}	. . . 64.50 per cent.
2 " 5 "		
3 " 6 "		
4 " 3 "		
5 " 5 "	}	
6 " 1 "		
8 " 3 "		
9 " 2 "		
10 " 2 "	}	. . . 35.50 per cent.
33 " 1 "		
34 " 1 "		
52 " 1 "		

To summarize :

Under 120 hours	64.50 per cent.
Over 120 "	35.50 "

Professor Von Ranke (*Munchener Med. Wochenschrift*, 1895, No. 8), performed in those cases of recovery, before serum treatment, final extubation, as follows :

Within 24 hours in 8 per ct.	}	72.50 per ct.
" 48 " 26 "		
" 72 " 18.50 "		
" 96 " 20 "		
Over 96 hours		27.50 per ct.

Of Von Ranke's cases 72.50 per cent. were extubated within ninety-six hours.

Huebner (*Klinische Studien über die behandlung der Diphtherie*, Leipsig, 1895), in twenty-five cases of recovery, has given 100 hours as an average when final extubation could be performed.

Johan Bokai (Stephanie Kinder Hos-

pital, Buda-Pesth), reports 673 cases intubated by himself before the serum period, of which 223, that is $33\frac{1}{3}$ per cent., were cured.

Of these 223 cases, eight were tracheotomized. If we subtract these, we have 215 cases in which the tubes were worn, as follows:

From $\frac{1}{2}$ to 24 hours in 27 cases, 12.55%	} 82.33%
" 24 to 48 " 56 " 26.04%	
" 48 to 72 " 52 " 24.18%	
" 72 to 96 " 29 " 15.50%	
" 96 to 120 " 13 " 6.06%	
From 120 to 144 hours, 21 cases,	} . . . 17.67%
" 144 to 168 " 6 "	
" 168 to 192 " 1 "	
" 192 to 216 " 2 "	
" 216 to 240 " 1 "	
Over ten (10) days 7 "	

The minimum duration in Bokai's cases was:

$\frac{1}{2}$, 1, $1\frac{1}{2}$, 2, 6, $6\frac{1}{2}$ and 9 hours.

The maximum duration was:

217, 218, 243, 247, 349, 353 and 368 hours.

Taking the number of hours ($17,050\frac{3}{4}$), and dividing by the number of cases (215), the average duration the tube was worn would be seventy-nine hours.

Bokai observes that in his hospital the removal was never attempted under forty-eight hours. In those cases (12.55 per cent), where the tube was worn not longer than twenty-four hours, the tube was either expectorated or withdrawn by pulling on the silk, which he always allowed to remain; and stenosis being relieved, no further intubation was practiced in that particular case.

PERIOD OF SERUM TREATMENT.

European—In juxtaposition to these statistics, I will now give the statistics influenced by the serum treatment:

Huebner (*Klinische Studien*, etc.) reports ten intubation cases treated with antitoxin, where the average duration was thirty-seven hours.

In Von Ranke's cases, the tube was removed

Within 24 hours, in 18 cases . 18.5	per cent.
" 48 " " 48 " . 48.1	"
" 72 " " 11 " . 11.1	"
" 96 " " 10 " . 10.0	"
Over 96 " " 3 " . 3.7	"

Of ninety cases intubated by Bokai since the serum period, forty-five recovered—fifty per cent.

Of these, one case (183 hours) was tracheotomized; therefore, forty-four cases were treated by simple intubation.

The duration of the intubation in these forty-four cases was as follows:

1 to 24 hours, 8 cases . . . 18.18	per cent.
24 " 48 " 18 " . . . 40.90	"
48 " 72 " 8 " . . . 18.18	"
72 " 96 " 4 " . . . 9.09	"
96 " 120 " 2 " . . . 4.54	"
120 " 144 " 1 " . . . 2.27	"
144 " 168 " 3 " . . . 6.84	"

Total, 44 cases.

In this group the minima was one and seven hours; the maxima, 150, 154, 160 hours.

Of these forty-four cases

77.26 per ct.	were extubated within 72 hrs.
13.63 " " "	between 72 and 120 hrs.
9.11 " " "	after 120 hrs.

To show the comparison between the two periods, before and after serum treatment, Bokai tabulates his cases as follows:

Duration of Intubation.	Before Serum Period Per ct. of Cures.	After Serum Period Per ct. of Cures.
$\frac{1}{2}$ to 24 hrs.	12.55 per cent.	18.18 per cent.
24 to 48 hrs.	26.04 "	40.90 "
48 to 72 hrs.	24.18 "	18.18 "
72 to 96 hrs.	13.50 "	9.09 "
96 to 120 hrs.	6.06 "	4.54 "
120 to 144 hrs.	} 17.67 "	2.27 "
144 to 168 hrs.		6.04 "
168 to 192 hrs.		
192 to 216 hrs.		
216 to 240 hrs.		
Over 240 hrs.		

This table shows that the number in the first and second twenty-four hours has conspicuously increased.

If we were to add the number of hours together, as in the former cases, we have 2683 hours, divided by forty-four (cases), the average is sixty-one hours against seventy-nine hours before the serum period.

Therefore the serum treatment has lowered the duration of intubation eighteen hours.

American—O'Dwyer intubated thirty cases since the serum period, of which twenty recovered— $66\frac{2}{3}$ per cent.

The duration of the intubation in nineteen of these cases was as follows:

8 hours, 1 case		
36	"	1
48	"	1
49	"	1
68	"	1
69	"	1
76	"	1
84	"	1
88	"	1
91	"	1
92	"	2
93	"	1
107	"	1
112	"	1
115	"	1
119	"	1
120	"	2

... 89½ per cent.

... 10½ per cent.

In this group the minimum was eight hours; the maximum, 120 hours.

Final extubation was performed in 89½ per cent. (seventeen cases) within 120 hours, and 10½ per cent. (two cases) at 120 hours.

If we add the number of hours the tube was worn (1587) and divide by number of cases (nineteen), it will give the average, 83½ hours, in comparison to 147 hours in such cases before the serum period.

Therefore, the serum treatment has lessened the time of intubation 63½ hours. O'Dwyer has written me that the average duration of intubation since the serum period has been eighty hours, making his reduction, therefore, sixty-seven hours.

Dr. Louis Fischer reports to me thirty cases of recoveries after intubation, since the use of the antitoxin. In his cases, the tube was worn as follows:

16 hours, 1 case		
24	"	1
36	"	1
48	"	3
52	"	2
64	"	6
72	"	1
76	"	1
84	"	1
96	"	1
116	"	1

... 63½ per cent.

128 hours, 1 case		
140	"	1
156	"	1
164	"	1
192	"	1
240	"	1
246	"	1
284	"	1
296	"	1
324	"	1
408	"	1

... 36½ per cent.

Total . . 30

In this group the minimum was sixteen hours; the maximum, 408 hours.

63½ per cent. were extubated before 120 hrs.
36½ " " " over 120 hrs.

To show the comparison between the two periods, before and after serum treatment, I tabulate Fischer's cases the same as Bokai's:

Duration of Intubation.	Before Serum Period Per cent. of Cures.	After Serum Period Per cent. of Cures.
16 to 24 hrs.	.....	2 cases, 6½%.
24 to 48 hrs.	.....	4 " 13½%.
48 to 72 hrs.	3 cases, 18.75%.	9 " 30%.
72 to 96 hrs.	1 " 6.25%.	3 " 10%.
96 to 120 hrs. and over.	12 " 75%.	12 " 36½%.

To summarize:

Before . 120 hrs. . 25 per cent. 63½ per cent.
After . 120 hrs. . 75 " 36½ "

This table shows that the number in the first three days has increased. If we were to add the number of hours together (3262) and divide by the number of cases (thirty), the average time would be 108½ hours. In comparison to the average time before the serum period, 176½, shows a reduction in the time tube was worn of sixty-eight hours.

The cases intubated by me since the serum period were as follows:

No.	Name.	Age. Yr. Mo.	Sex	Complications.	Case of	Tube worn.	Antitoxin used and time of injection.
1	E. H.	1 6	M.	Tonsils [monia	Dr. H. H. Freund	21 hours	Behring's No. 2 (1000 units) 60 hrs.
2	A. S.	2 8	F.	Faucial, Bron. Pneu.	Dr. L. Wolff	91½ hours	Behring's No. 1 (600 units) 3d day
3	I. S.	4	F.	Tonsils [monia	Dr. E. Rosenthal	Expell. 48 hrs.	Behring's No. 2 (1000 units) 6th day
4	T. G.	1 1	M.	Faucial, Bron. Pneu.	Dr. E. Rosenthal	73½ hours	Behring's No. 1 (600 units) 4th day
5	M. E.	1 7	M.	Sepsis	Dr. J. J. Owen	49 hours	Behring's No. 2 (1000 units) 72 hrs.
6	E. C.	2 2	M.	Nephritis Sepsis	Dr. H. H. Freund	31 hours	Behring's No. 2 (1000 units) 5th day
7	M. G.	2 9	F.	Tonsils	Dr. L. Wolff	Expell. 12 hrs.	Behring's No. 1 (600 units) 30½ hrs.
8	G. W.	2	M.	Tonsils	Dr. E. Rosenthal	6 days, 10 hrs.	Behring's No. 2 (1000 units) 4th day
9	M. H. G.	3 4	F.	Tonsils [monia	Dr. E. Rosenthal	6 days, 2 hrs.	Behring's No. 2 (1000 units) 6th day
10	A. W.	1 10	F.	Tonsils, Bron. Pneu.	Dr. C. D. Spivak	12 days, 3 hrs.	Behring's No. 2 (1000 units) 3d day
11	L. K.	6 8	F.	Tonsils and Pharynx	Dr. G. Metzler	4 days, 2 hrs.	Mulford's (700 u) Beh. (1000) 3d day
12	H. G.	5	F.	Faucial, Bron. Pneu.	Dr. G. Metzler	4 days	Aronson's (5 c.c.) Beh. (1000) 2d day
13	L. M.	3	M.	Tonsils [monia	Dr. L. E. Taubel	11 days	Mulford (2300 in 2 injec.) 3d day
14	H. K.	3 6	M.	Faucial	Dr. Klein (assisted)	82 hours	Mulford (2000 in 2 injec.) 2d day
15	A. W.	5	M.	Tonsils	Drs. Taubel & Simpson	7 days, 6 hrs.	Mulford (1500 in 2 injec.) 3d day
16	D. G.	2 2	F.	Faucial	Dr. L. E. Taubel	4 days, 7 hrs.	Mulford (1500 in 2 injec.) 7th day
17	G. W. L.	4	M.	Faucial	Dr. G. A. Muehleck	6 days, 12 hrs.	Aronson's (5 c.c.) 3d day
18	B. E. T.	11	F.	Following Measles	Dr. G. A. Muehleck	4 days	Aronson's (5 c.c.) 3d day
19	M. L.	3 11	M.		Drs. Rosenthal, Freund, M. V. Ball & Golden	70 hours	Mulford's (2000 units in 2 injec.) 4th day. 1 c.c.—500 units (ex. potent)
20	K. L.	2 3	M.	Following Measles	Drs. B. Segal & Golden	75 hours	Mulford's pot. (1 c.c.—250 units) 3d day. (1000 units)

Of these, two died—ten per cent.

In those cases recovered, the duration of intubation was as follows:

1 case, 12 hours	} . . . 66 $\frac{2}{3}$ per cent.
1 " 21 "	
1 " 48 "	
1 " 70 "	
1 " 73 $\frac{1}{2}$ "	
1 " 75 "	
1 " 82 "	
1 " 91 $\frac{1}{2}$ "	
2 " 96 "	
1 " 98 "	
1 " 103 "	} . . . 33 $\frac{1}{3}$ per cent.
1 " 146 "	
1 " 154 "	
1 " 156 "	
1 " 174 "	
1 " 264 "	
1 " 291 "	

If we add the number of hours the tube was worn (2054) and divide by the number of cases (eighteen), it will leave the average, 114 $\frac{1}{3}$, in comparison to those cases before the serum period, 185 $\frac{1}{2}$, showing a reduction of 71 $\frac{1}{2}$ hours.

Tabulating my cases as are Bokai's, the result is as follows:

Duration of Intubation.	Before Serum Period Per cent. of Cures.	After Serum Period Per cent. of Cures.
18 to 24 hrs.	.....	2 cases, 11 $\frac{1}{3}$ %.
24 to 96 hrs.	12 cases, 31.5%.	7 " 38 $\frac{3}{8}$ %.
96 to 120 hrs.	6 " 16%.	3 " 16 $\frac{2}{3}$ %.
120 to 248 hrs.	18 " 48%.	5 " 27 $\frac{1}{3}$ %.
248 hrs. and over	2 " 5.5%.	1 " 5 $\frac{5}{9}$ %.

To summarize:

Before 120 hours . . . 47.5 per cent. 66 $\frac{2}{3}$ per cent.
After 120 " . . . 52.5 " 33 $\frac{1}{3}$ "

In the operation of tracheotomy, I have had no personal experience, but quote E. Kohl (*Yahrgang des Archives fur Klinische Chirurgie*, 1887), who speaks of the difficulty of decanulement after the operation, and places in substantiation the literature up to that date.

The difficulty (after a study of 800 cases of recovery) he assumes to be when the final decanulement cannot take place after three weeks.

There were

In 24 cases final removal in 3 days.
" 71 " " " 4 "
" 94 " " " 5 "
" 30 " " " between 6 and 10 days.
" 200 " " " 10 " 30 "
" 50 " " " 1 " 12 mos.

In conclusion, Kohl mentions one case in which it was impossible to do

away with the tube, which was worn constantly, even to the present time.

Bokai's experience in tracheotomy is as follows:

In the majority of his cases (eighty-four per cent.) he was enabled to withdraw the tube within ten days; the sixth or seventh day, 44 $\frac{1}{2}$ per cent.; five days, 23 $\frac{1}{2}$ per cent.

In presenting the cases of Kohl and Bokai, and placing them in comparison with the results of intubation, the results should claim the attention of everyone, and they are the convincing factors which prove my convictions against tracheotomy in favor of intubation.

To compare:

Days.	Tracheotomy. Per ct. of Cures.	Intubation. Per cent. of Cures.
KOHL'S		
Under 5 days.	23 $\frac{5}{8}$ per cent.	.....
Bet. 5 and 10 days.	37 $\frac{3}{8}$ "	.....
Over 10 days.	38 $\frac{7}{8}$ "	.....
BOKAI'S		
Under 5 days.	23 $\frac{1}{2}$ per cent.	83.08 per cent.
Bet. 5 and 10 days.	60 $\frac{1}{2}$ "	16.02 "
Over 10 days.	16 "	.....
O'DWYER'S		
Under 5 days.	.....	89 $\frac{1}{2}$ per cent.
Bet. 5 and 10 days.	.....	10 $\frac{1}{2}$ "
Over 10 days.	.....	.....
FISCHER'S		
Under 5 days.	.....	63 $\frac{1}{3}$ per cent.
Bet. 5 and 10 days.	.....	16 $\frac{2}{3}$ "
Over 10 days.	.....	20 "
ROSENTHAL'S		
Under 5 days.	.....	66 $\frac{2}{3}$ per cent.
Bet. 5 and 10 days.	.....	22 $\frac{2}{3}$ "
Over 10 days.	.....	11 $\frac{1}{3}$ "

As there are always physicians who prefer tracheotomy to intubation in the operative treatment of diphtheria, it is advisable to call their attention to the cases I have quoted.

Bokai's cases show the average duration of intubation seventy-nine to sixty-one hours, and in the majority of his cases (83.08 per cent.) final extubation was performed within five days (120 hours), even though a relatively large number (in 217 cases, forty-two—16.2 per cent.) were intubated over five days, without the longer intubation being in any way dangerous. Under the serum treatment no alarming symp-

toms (decubitus, etc.) were manifested. For that reason but one conclusion can be borne—that the operation of intubation is alone sufficient, and the secondary operation of tracheotomy can be avoided.

O'Dwyer's cases show the average duration of intubation to be about eighty hours, and in almost all his cases final extubation was performed within five days. I quote from a letter received by me from Dr. O'Dwyer, which most forcibly demonstrates the utility of the serum treatment:

My results up to the present time in 500 cases, in a service of hundreds:

First 100, largely experimental, 17 recoveries.	
Second 100	27 "
Third 100	30 "
Fourth 100	26 "
Fifth 100	39 "

The marked increase in the last series was due to the antitoxin, in thirty cases of which there were twenty recoveries. In the seventy preceding cases, in which no antitoxin was used, there were only nineteen recoveries, which was about the same percentage as in all the other series.

O'Dwyer's statistics substantiate my own. From a mortality ranging from eighty-three to seventy per cent. before the serum period, his reduction has been to thirty per cent.; and the reduction in time the tube was worn, sixty-seven hours.

Fischer's cases show the same characteristics as O'Dwyer's cases and my own. The average duration of intubation was $108\frac{3}{4}$ hours, and in $63\frac{1}{2}$ per cent. final extubation was performed within 120 hours. In one of Fischer's cases, seen with Prof. H. J. Boldt, intubation and extubation was performed five different times during a period of 408 hours, which somewhat raised his average. However the reduction in time the tube was worn is equal to O'Dwyer's and my own, and averages $68\frac{1}{10}$ hours.

The relatively large number (in thirty cases, eleven— $36\frac{2}{3}$ per cent.) were intubated over five days (120 hours). No dangerous symptoms arose necessitating tracheotomy.

Intubation, with the serum, has been sufficient in Fischer's hands to perform a cure.

My own series of cases show the average duration of intubation, with serum treatment, to be $114\frac{1}{2}$ hours. And in the majority of my cases (12) final ex-

tubation was performed within five days. In long cases I have never seen any indication that would call for tracheotomy, and in one of my cases intubation and extubation was performed very frequently with favorable results.

In presenting this paper, I have refrained from mentioning those cases of laryngeal diphtheria treated with antitoxin, which recovered without the aid of intubation. These cases were in greater number than those operated, and the reason has unquestionably been due to the early use of antitoxin.

My conclusions, after using the serum treatment the last eighteen months, are as follows:

1st. The duration of intubation varies.

In the cases just quoted, extubation has been made in from one-half to 408 hours. The rule, however, in the majority of cases has been that final extubation can be performed within 120 hours.

2d. The average length of intubation has been reduced to a marked degree.

EUROPEAN OBSERVERS.

Bokai	18 hours.
Von Ranke	$25\frac{1}{2}$ "
Huebner	63 "

AMERICAN OBSERVERS.

O'Dwyer	67 hours.
Fischer	$68\frac{1}{10}$ "
Rosenthal	$71\frac{1}{6}$ "

3d. The operation of tracheotomy is avoided, intubation being sufficient to cure even the long cases (five days and over), and there were no symptoms necessitating such a procedure.

4th. The use of serum has placed intubation on a definite basis by

(a) Lowering the mortality.

(b) Shortening the period of intubation.

(c) Avoiding the major operation of tracheotomy.

DISCUSSION.

DR. WELCH, Philadelphia:—I did not intend to take part in this discussion, but I am obliged to say that my experience is not in accord with the author of the paper. He contends that the tube may be removed much earlier when antitoxin is used than when it is not. In order to determine that fact, it is necessary frequent experiments should be made in removing the tube every day, both in the non-antitoxin and in the antitoxin cases,

to ascertain the earliest period of disease in which the patient can get along without the tube. No such experiment has been made.

Before the introduction of antitoxin, we were told that it was necessary the tube should remain six, seven or eight days. O'Dwyer's instruction is that the tube may be removed on the seventh day, unless the patient be a great distance; then it should be retained eight days. I think this was pretty generally followed before the introduction of antitoxin. But it is not known just how soon a patient can get along without a tube. That can be ascertained only by removing the tube and learning.

Since antitoxin has come into practical use, some writers are claiming the patient can earlier dispense with the tube; and they have found by experiment that some cases get along without using the tube.

This conclusion, however, is scarcely warranted, unless experiment is made of the two cases in precisely the same way.

As to my own experience. I have tried removing the tube at an earlier period of the disease, but I have repeatedly found that I had to reintroduce it. We first thought that, with the use of the antitoxin, we could get along without the tube after four days; but, often, we found that we had to hustle to get the tube back to save the child's life.

A patient in one of the wards of a hospital in Philadelphia wore a tube three months. During the three months the tube was removed or coughed up as often as seventy times, yet it was impossible to get along without it. The child, in its night clothes, often would run into the sleeping room of the resident physician, carrying in its hand the tube, which had been coughed out. The physician would reintroduce the tube, and the child would go back to bed. I have seen the child, and I am sure it would not have lived fifteen minutes if the tube had not been reintroduced. As I stated, that child was required to wear that tube three months.

Frequently the tube has to be retained as long as three weeks, even where the antitoxin is used.

Not long ago, a patient was sent to the hospital, who had already received antitoxin. A number of hours later—perhaps a day; I think it was not so long as twenty-four hours after—intubation was necessary. It was found to give temporary relief. The child was then sent to the hospital in that condition. After six days we thought we might remove the tube, and did so. Serious symptoms at once developed; the tube was reintroduced and worn four days longer. We thought then we could remove the tube, and did so. The resident physician told me he had to make all possible haste from some other part of the institution, and put the tube back, in order to save the child. The morning of the eleventh day, at about five o'clock, the child coughed out the tube. Its condition at once became serious, and the nurse telephoned to the other

building for the resident physician. The latter did not stop to change his shirt, but hurried across the grounds. Before he arrived, that child was dead. It was an antitoxin case.

I have very frequently met with cases where the tube is coughed out and the child gets along very well, no matter whether it has taken the antitoxin or not. I frequently have had children do pretty well after the tube was introduced and taken out immediately. They breathed better for a time.

DR. T. D. DAVIS, Pittsburg:—I have had considerable experience, personally, in the use of antitoxin. We ourselves make it in Pittsburg, and we know it is good. We know its strength and we know the results.

At the last meeting of the Allegheny County Medical Society, the subject was up before the members. There was not one single remark made by any doctor present derogatory to its great efficiency. Some of the cases reported were little short of miraculous.

In my personal practice I have seen two cases where the child was, as it were, snatched as "a brand from the burning," by its use. You can use antitoxin, and you can use antitoxin. There are various ways of doing it. Because a man says a case has been treated with antitoxin and dies, it does not follow, therefore, that antitoxin was of no value, nor that it could not have been of greater use in that individual case. A great deal depends on *how* it is used, the *quality* and *quantity* used, and the *time* of use. If you have a patient suffering with malaria and give one small dose of quinine, you treat the patient with quinine, but how? The same applies to the treatment of diphtheria with antitoxin. If you administer 500 units when it requires 5000 units to neutralize the poisons or toxins, your patient will die; not on account of the antitoxin, but because you have not given a sufficient amount.

If our theory in regard to the serum is correct, it is one of the few remedies that are beneficial whether it cures the diphtheria or not. It not only is harmless, but it is beneficial. You are putting food into the body. You cannot possibly cause injury by it, if it is pure and good. You absolutely benefit in the same way as by injecting milk or beef tea. Therefore, you are not using a dangerous remedy.

In one of the cases reported at the Allegheny County Society, 142 cubic centimetres were used, within thirty-six hours, in the case of a child seven years of age, and with recovery.

In regard to the remarks just made: How would you know more by experiments made as suggested? Antitoxin does not propose to remove spasm of the larynx, nor to reduce congestion, or an indamed condition. Antitoxin proposes to remove the diphtheria and not its results. I know, when I use it, when the membranes have disappeared I am free to say whether the tube can be removed or not.

I know that I have never seen a case, under the use of antitoxin, in which the membrane lasted over forty-eight hours. If this membrane was in the larynx and the intubation was solely on account of the membrane, I would then take it away. If there was spasm of the larynx and congestion remained, then such would have to be treated. The antitoxin would have no effect in such a condition, as it cures only the diphtheria.

DR. ROSENTHAL :—The statement made by my friend from Pittsburg is exactly what I wish to emphasize. Whilst antitoxin is a specific for diphtheria, one must know how to use it. If you give but one administration, the child may not recover. I have seen recoveries in laryngeal diphtheria in almost hopeless cases that were intubated. I am ready to stand with the antitoxin or to go down with the antitoxin. While it is of signal importance to employ antitoxin as early as possible, I never despair, even when called late. Of course, in such cases I give larger amounts of antitoxin—2,000 units as an initial dose.

The antitoxin which I have presented here is exhibited in three grades of strength. If physicians will use it precisely as I have directed, and there are any failures, let them be attributed to me.

I do not know much about the Philadelphia Municipal Hospital, but it stands unique in its mortality-record, which is the greatest in the world to-day, and it is the only institution that has not reduced its mortality-rate since the introduction of antitoxin.

I have presented a number of cases whereby my conclusions are proven, and if the opportunity were offered, I could demonstrate the same facts at the Philadelphia Municipal Hospital. I have daily reports made, with analyses of urine, etc., and in no case has albuminuria been noted. I have not noted any joint pains. In a few instances a slight urticaria, which soon disappeared, was noted, but I have noted the like in cases treated by me before the serum period.

Dr. J. S. Billings, Jr., asserts (*Medical Record*, April 25th) that the "antitoxin treatment has no deleterious effects upon the blood corpuscles. On the contrary, it seems to prevent degenerative changes which would otherwise be brought about."

A knowledge of the duration of the period of intubation ought to be of some value. When I inject the antitoxin in quantity insufficient to ascertain the result, I repeat with an increased number of units, and when the symptoms are favorable, I take the tube out. In one case it remained 148 hours, but this was not due to antitoxin.

I do not like statistics that are incorrect, and long to have them made right. When one has exhibited antitoxin and, on the second

day, the temperature again rises, it is because of insufficient use and indicates the further need of antitoxin. Then I give it in double or treble quantity; if my first injection was of 1,000 units, I administer 2,000 units, and should the third injection be necessary, 3,000 units.

But to use antitoxin for complications you may as well expect a dose of quinine to give beneficial results to a man who has an abscess of the liver. Antitoxin will cure diphtheria. And I know that it decreases the mortality, and that it reduces the time the tube must be worn. Dr. Fischer and Dr. O'Dwyer, of New York, the originator of the tubes I have shown, will maintain the same opinion.

DR. W. B. ULRICH, Chester :—Before the Doctor takes his seat, I would like to have this question answered by him and by Dr. Welch: Have you ever known of any harmful results from the use of antitoxin? I, myself, would not feel, with my experience in its use, that I had done my whole duty if not using antitoxin in diphtheria, notwithstanding my skeptical views when antitoxin was first introduced. I would like to have this question answered before the Society.

DR. ROSENTHAL :—I have used as high as 13,000 units in one case, with curative results.

DR. ULRICH :—Have you had any harmful results?

DR. ROSENTHAL :—No, sir! Neither have I found any by examination of the urine. There is a difference in the injection, depending upon the kind of antitoxin you use. Gibier's antitoxin can be used in enormous amounts with scarcely any effect.

DR. ULRICH :—What kind of antitoxin serum do you use?

DR. ROSENTHAL :—I use Mulford's exclusively in my practice. Of the Mulford product you can secure three different strengths: The "Standard," containing 100 units to each c.c.; the "Potent," containing 250 units to each c.c.; and the "Extra Potent," containing 500 units to each c.c., each of these strengths being supplied in vials of 500, 1000 and 2000 units.

The charts I have shown the Society were of cases treated with the "Potent" and "Extra Potent." In one case the tube was withdrawn within seventy hours, and the child was cured; in the other case within seventy-three hours, with like results. I have never seen an unfavorable symptom where Mulford's antitoxin was administered. I now use it exclusively, because it has given me results more prompt than any other antitoxin I have ever employed.

DR. WELCH :—I have never seen any fatal results, but I have seen some complications arising from urticaria and joint pains.

